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**PTERODRILUS, A REMARKABLE DISCODRILID.**

BY J. PERCY MOORE.

Among a number of additional new species of Discodrilidæ, which have come into the writer's possession, are two which differ so remarkably from the known type of structure of these interesting parasites that an immediate description of their peculiarities seems desirable. A new genus, *Pterodrilus*, is proposed for them, characterized by the presence on certain of the post-cephalic somites of paired dorsal appendages, chiefly developed from the muscular layers of the body walls. The genus resembles American Discodrilids hitherto described in the presence of a second pair of vasæ deferentiæ in the VIth post-cephalic somite, in addition to the pair in the Vth somite, which alone is present in the European *Branchiobdella*. Both pairs open to the exterior in the VIth somite by the usual form of efferent apparatus. The dorsal and ventral cuticular jaws are similar to one another, and each is normally bi-laterally symmetrical, though not infrequent variations affecting this symmetry are notable. The external openings of the anterior pair of nephridia are united in a common muscular vesicle having an outlet on the dorsum of somite III.

In the two species at present known the spermatheca is a simple sac with glandular and muscular walls, opening on the ventral middle line of the Vth somite. The atrium shows the usual division into bursa, penis sheath, and glandular atrium, the vasa deferentia opening into the latter, which is short and stout. The ovaries are attached to the posterior face of the septum VI-VII, and the ovipores are situated between the major and minor annuli of somite VII.

As usual in the Discodrilidæ the nervous system consists of a doubly bi-lobulate supra-oesophageal ganglion, united by partly ganglionic circum-oesophageal connectives with the ventral nerve cord, which develops three pairs of deeply bilobed cephalic ganglia, eight pairs of double post-cephalic ganglia, and a posterior nerve mass composed of three fused pairs of double ganglia, making a total of eleven post-cephalic ganglia, corresponding to the eleven bi-annulate body somites.

The vascular system presents the usual supra-intestinal vessel with its anterior portion modified to form a heart, a supra-neural vessel, a peri-enteric blood sinus, four pairs of vascular arches in the head, one pair each in the I<sup>st</sup> and VII<sup>th</sup> post-cephalic somites, and one pair uniting the longitudinal trunks posteriorly in the IX<sup>th</sup> and X<sup>th</sup> somites. Two pairs of cephalic, and eight or ten of caudal, adhesive glands are present, as well as circum-oral and hypodermal mucous glands. An inconspicuous clitellum is developed on somites VI and VII. No salivary gland, such as is found in *Bdellodrilus illuminatus*, is present.

Regarding the function of the dorsal organs there is little to say. A priori one would expect them to be respiratory, but the apparent entire absence of bloodvessels, which are unrevealed after a careful study of sections, would tend to throw strong doubt upon such an interpretation. Irregular spaces are evident here and there between the muscle fibres, but these appear to be continuous with the intermuscular spaces which are developed between the circular and longitudinal muscle fibres of the body walls, and have not been traced into any communication with the body cavity. Until an opportunity is afforded of studying living examples in their proper habitat, and observing the uses to which these organs are put, no opinion can be vouchsafed.

The two species are of relatively minute size, and were at first regarded as larval stages of another Discodrilid, until sections revealed the presence of perfectly mature spermatozoa and ova, some of which latter were in the course of extrusion through the ovipores.

*Pterodrilus alcicoxus* sp. nov.

Pl. XIII, fig. 1, profile of entire animal, from a mounted specimen about half extended, showing also the course of the alimentary canal, the spermatheca, atrium, and vasa deferentia, the position of the ovary and ovipores of the right side, and the dorsal gland in the VIII<sup>th</sup> somite. X 145.

Fig. 1 $\alpha$ , one of the jaws. X 640.

Fig. 1 $\beta$ , transverse section through the anterior part of the VIII<sup>th</sup>, post-cephalic somite, passing obliquely into the ventral part of the VII<sup>th</sup>; the ovary is cut on one side, and the muscular septum on the other; the intestine and nerve cord are shown;  $\alpha$ , intermuscular space. X 200.

Fig. 1c, a longitudinal section near the median line of the dorsal organ of somite VIII; *a*, intermuscular spaces. X 500.

Fig. 1d, section of a terminal portion of a dorsal appendage. X 640.

In this species, which is described from sections and specimens mounted entire, the body is terete throughout, or owing to the increase in thickness of the dorsal walls of the major annuli, appears somewhat compressed at these points. The somites VI, VII., and VIII are of about equal diameter, those anterior and posterior to them tapering respectively toward the head and caudal disk. Bi-annulation of the body somites is very marked. The head is rather slender, and consists of a circum-oral annulus divided into thick entire dorsal and ventral lips, and two similar post-oral rings. The caudal sucker is a muscular disk of simple form, and about the diameter of the 1st post-cephalic somite; its axis coincides with that of the body somites.

Dorsal organs are highly developed in this species on post-cephalic somites III, IV, V, and VIII. Somites VI and VII, and in less degree, II also, exhibit slight dorsal thickenings of the body musculature. On the dorsum of the major annulus of somite III the body walls rise into a high compressed transverse ridge or plate, which fades out on the sides of the somite, and is produced laterally into a conspicuous, forwardly projecting trilobed wing, the anterior division of which flares outward and extends far forward over somite II, usually ending in a slightly bifid expansion. The remaining lobes are simple conical tines, which project upward and slightly outward. The two wings flare so strongly that the distance between their apices is about  $1\frac{1}{2}$  times the diameter of the somite. Their shape is very strongly suggestive of the antlers of a young moose, hence the name given to this species. The generic name was also suggested by this species, in which the dorsal organs have a wing-like aspect not seen in the other species.

The dorsal appendage of the VIIIth somite is also highly developed, and similar to the one just described. Its lateral wings, however, are less conspicuous, and are directed posteriorly instead of anteriorly, and also flare outward more conspicuously. The whole organ is strongly concave behind, while that on the IIIrd somite is similarly concave before. A small gland, closely resembling a clitellar gland, is sometimes present (in two out of three series of sections)

embedded in the base of the organ on each side. On the IVth and Vth somites the appendages are less highly developed, but are similar, the low dorsal ridges bearing on each side a pair of slender and simple cylindrical processes.

An examination of figures 1*b*, 1*c*, and 1*d* will make the structure of the characteristic dorsal appendages clear. The transverse dorsal ridges are built up chiefly of short, thick, longitudinal muscle fibres, which extend between the anterior and the posterior covering of hypodermis. Spaces partly filled with a connective tissue network are observable among the fibres, and a similar more extensive space (*a*, figs. 1*b*, 1*c*), separates the muscles of the dorsal organ from the longitudinal muscles of the body walls. A few vertical muscle fibres are also developed in the lateral margins of the ridges. Over this firm muscular basis the hypodermis, with the circular muscle layer, extends, and this alone, with a core of loose, spongy tissue, probably derived from the subdermal connective tissue, forms the terminal processes and lobes, (fig. 1*d*.) In the formation of these dorsal appendages, from the body walls, it would seem that the loose fold of hypodermis and circular muscle fibres that rises freely from the longitudinal muscle fibres is pinched up, as it were, at several points, from which the skin and connective tissue underlying it proliferate to form the marginal processes, while the space remaining becomes filled, save for a few narrow clefts, with muscle fibres that proliferate from the ends of the longitudinal muscle fibres of the body walls at the points where these meet the hypodermis.

The alimentary canal is enlarged to form a saccular stomach in the four anterior body somites, while posteriorly it is narrow and tubular, and, with the exception of a slight transverse loop in the VIIth and VIIIth somites, proceeds directly to the anus on the dorsum of somite X.

The jaws are small, measuring .02 mm. in breadth. They are of similar form, being quadridentate, with a median pair of long, sharply-conical, widely-separated, and divergent teeth, bent at a nearly right angle from the plane of the somewhat quadrangular basal plate. In extreme lateral positions are a pair of inconspicuous blunt teeth. When in position the basal plates are fixed in the cuticle of the pharynx, and the points of the teeth of the two jaws cross in the pharyngeal lumen.

The spermatheca lies in the Vth somite to the left of the intestine.

Its lower half is narrow and cylindrical, its upper abruptly expanded.

The copulatory bursa is rather thin walled, and with the penis is capable of complete invagination. The penis sheath is relatively short, and exhibits no muscular atrial enlargement at the upper end. The glandular atrium is short, nearly spherical, and thick walled. It receives the vasæ deferentiæ, which are of the usual form. In the mounted specimen, from which figure 1 was drawn, the atrium was twisted so that in the figure the anterior end is directed posteriorly.

The common opening of the anterior pair of nephridia is located on the dorsum of the major annulus of somite III, immediately posterior to the dorsal appendage.

The largest examples found among about a dozen specimens measure about 1 mm. in length.

This species was found on *Cambarus acuminatus*, in the Johns River, Watauga Co., N. C., in the summer of 1893; but what part of the crayfish it inhabits was not determined, nor have cocoons been found.

*Pterodrilus distichus* sp. nov.

Pl. XIII, fig. 2, profile of entire animal, showing intestine, spermatheca, atrium, ovary and ovipore of one side, etc. X 145.

Fig. 2a, a jaw. X 640.

Fig. 2b, transverse section through the VIIIth somite, showing the dorsal appendages, and the thickening of the body wall, with the intestine, nerve cord, and portion of a nephridium. X 145.

Fig. 2c, the male efferent apparatus, figured from a dissection; a, glandular atrium; b, copulatory bursa; c, penis sheath; d, bursal glands. X about 200.

Fig. 2d, section across the glandular atrium. X 500.

In form this species is similar to *P. alcicornus*, but the head is rather more robust, and the VIIth somite is of greater diameter than VI or VIII.

Dorsal appendages are present on post-cephalic somites II to VIII inclusive, and are much simpler than in *P. alcicornus*. The dorsal ridges are not compressed and plate-like, and are similar on all the somites. On somites II to VII each bears a pair of bluntly pointed cylindrical lateral appendages, while somite VIII bears two pairs; they become somewhat larger anteriorly.

These appendages contain no longitudinal muscle fibres, and the

ridges on which they rest are largely formed, as shown in fig. 2*b*, of a muscular network derived from the circular fibres.

In somites VII and VIII a complete transverse loop is developed on the intestine, which is otherwise as in *P. alcicornus*. The jaws are also very similar, but differ in the shorter median pair of teeth, and the stouter form of the basal plate. These distinctions are exaggerated in the figures owing to the fact that they are represented in slightly different positions, fig. 2*a* being somewhat foreshortened.

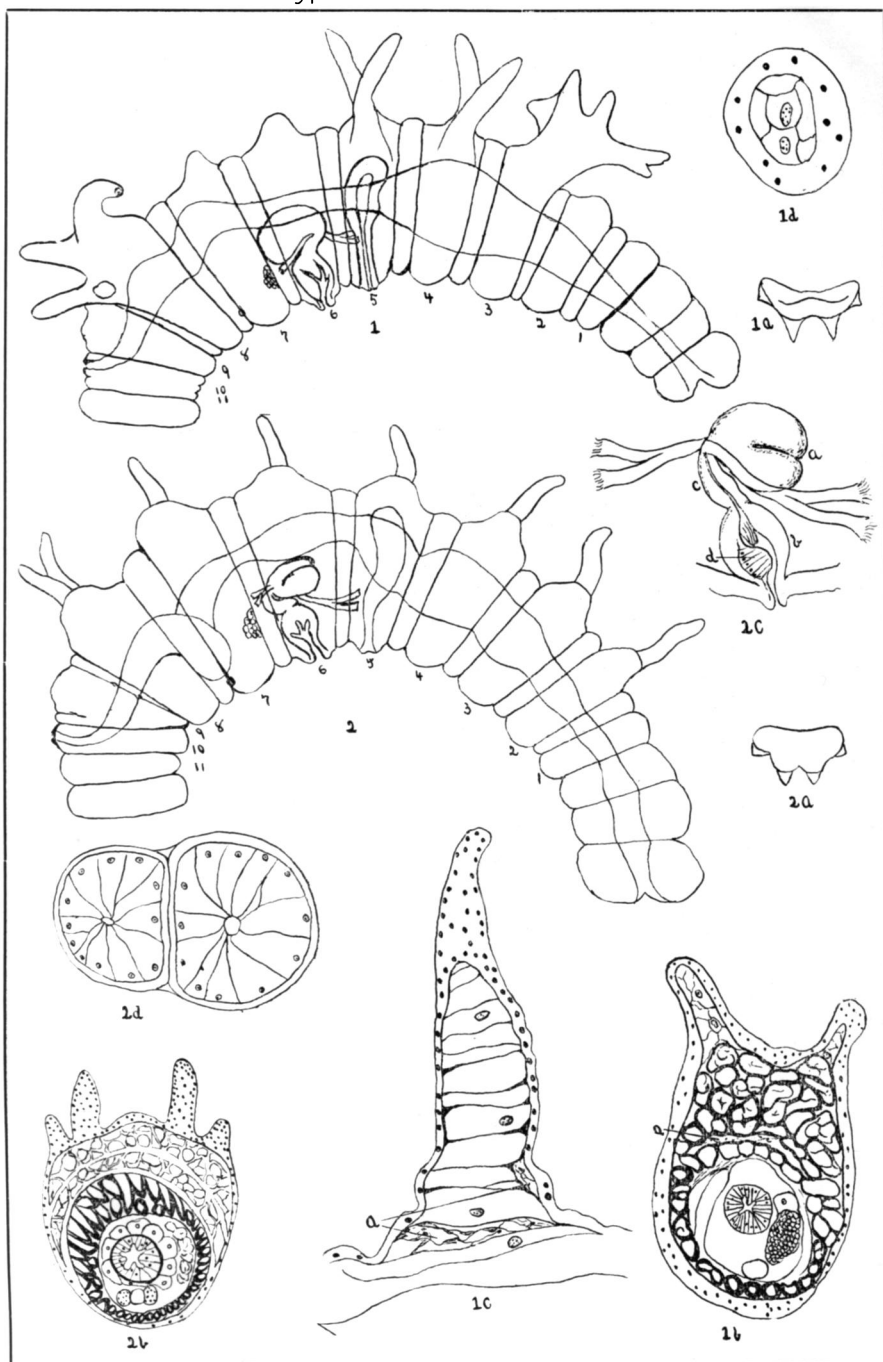
The spermatheca is slender and clavate, and regularly tapers from blind end to mouth. It lies to the left of the intestine. The copulatory bursa is nearly spherical, with thin muscular walls, and larger bursal glands than *P. alcicornus*. Its inner surface is thrown into deep ridges, among which the penis lies. The whole structure, when evaginated is shaped not unlike a mushroom, and resembles the corresponding parts of *Bdellodrilus philadelphicus*. The glandular atrium is remarkable in being divided by a deep cleft into two similar lobes, the structure being flattened in a plane perpendicular to this cleft, giving the organ a shape much resembling the conventionalized heart. The penis sheath is short, and lacks a sacular dilation.

The anterior nephridial pore is on the crest of the ridge of the IIIrd somite. In other respects this species resembles *P. alcicornus*.

The largest example (from which the dissection fig. 1*a* was made) from among upwards of fifty specimens measured 1.5 mm. in length, the usual size being about 1 mm.

Some small cocoons which may belong to this species were found attached to the setæ at the bases of the thoracic appendages of the crayfishes from which the specimens were obtained. Unfortunately the animals were not discovered while yet alive.

*P. distichus* was found in great numbers with *Bdellodrilus philadelphicus*, *B. manus* n. s., and *Branchiobdella instabilia* upon specimens of *Cambarus bartonii*, from western New York, for which I am indebted to the kindness of Mr. Albert E. Lewis.



MOORE ON PTERODRILUS.